Infection Control through the Work Order Process in Health Care Facilities

A Capstone Project Report

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Abstract:

Construction, demolition, and maintenance projects in the hospital setting and in other health care facilities provide a challenging and rewarding employment opportunity to the construction trades. This type of work is significantly different than in other types of commercial settings in the fact that patient safety through the environment is first and foremost. Working both efficiently and safely maximize process improvement and overall employee satisfaction throughout an organization by understanding the policies and expectations. It also requires a sharing of knowledge through all of the construction trades about complex issues such as infection prevention, containment types, specialty tools, proper dress, and how critical communication is.

In 2017, The Joint Commission, a major hospital accrediting body, addressed several issues that relate to construction, maintenance, and demolition. The need to have an Infection Control Risk assessment for work orders to ensure hospital trades are minimizing the risk of spreading infection through health care facilities is a top priority. The Joint Commission does not set out how hospital workers should do their jobs, but it is looking to see ways in which health care facilities take action to adequately address the issue of infections spreading through construction, maintenance, and demolition.

Having a clearly defined process in place to address work orders as they come into the computer maintenance management system (CMMS) will help identify the level of infection control needed, the tools, barriers, and specialty items to minimize the risk of exposing patients to infections. The process will include identifying the critical areas of the hospital, the flow of work identification, (regular power tools are not allowed without HEPA filters in certain regions), barriers, and materials, if any, as well as any associated costs.

Introduction:

Infectious agents can and will transmit diseases, whether that's through bacteria, viruses, fungi, or molds. This is done in a health care setting through building materials referred to as reservoirs (drywall, spaces between stud walls). They often include items such as ductwork, plumbing systems, drywall, and cooling towers. Bacteria that are typically resistant to antibiotics are responsible for a range of illnesses. In addition, SARS (2002) and the Coronavirus (2020) are just a couple examples of viral infectious issues we have faced, with outbreaks on a global level. Fungi tend to grow around leaky pipes or condensation in a bathroom, while molds can be much more harmful due to being transmitted through the airflow and movement of materials. Aspergillus is just one type that is easily communicated through such means and can wreak havoc through a healthcare facility compromising immunocompromised patients. When these bacteria partials are airborne, they can also land on open wounds and sores and cause Aspergillosis, an infection that can impact the entire body*. "A. flavus is the second leading cause of invasive and non-invasive aspergillosis (Denning, 1998; Morgan et al., 2005)."*

The chain of infection is necessary for an infection to occur. Below are the steps:

1. Infectious agent
2. Reservoir
3. Portal of exit
4. Mode of transmission
5. Portal of entry
6. Susceptible host

Any break in the chain of six steps will drastically disrupt the ability of the infection to continue to spread. Once building material becomes wet, they become a perfect breeding ground for these infectious agents. Disturbing building materials that have become contaminated with an infectious agent could release spores carrying the agent into the air.

The Joint Commission requires an infection control risk assessment to be completed before the start of construction, maintenance, or demolition. The Risk assessment form is allowed to be different from facility to facility, and it will need to be

based on the facility's type. The requirements, though, must focus on the minimization or reduction of infection risk, and it has fourteen steps. Before work is done a gathering of information related to the patient's risk and work area must take place. This information is then placed on the infection control risk assessment form found in appendix B (edits have been made for this project). The information is used as a guide throughout the work being completed. It is essential when conducting an assessment to inspect the areas around the work to ensure that the work being completed will not compromise the surrounding areas. Anything leaving the work area will provide a means for the infection to spread through the air, clothes, and contaminated materials.

Due to these issues and the findings from a mock survey in 2017, as well as the director and associate director's input they saw the need to maximize the Hospitals infection control practices through the work order process moving forward. Quality in health care is centered around patients and or by everyone who is around or in the proximity of patients. Looking for and identifying hazards and mitigating them has to be a part of every hospital's core values. Maintenance, construction and demolition activities that have significant hazards with dust and debris could cause severe issues with patients, staff and visitors. Not identifying such issues and risks can lead to citations by the Joint Commission, the accreditation body for most American hospitals. Having fully trained facilities, safety and infection prevention staff that are fully competent, effective and compliant in applying these infection prevention practices is a best practice every health care facility should follow.

Problem Statement:

The facility does not have procedures outlined through the work order process for maintenance staff regarding the evaluation of the impact that work will have on infection control while conducting maintenance and repair from work order submissions (the work will also apply to contractor construction) .Also, there are no current floor plans that outline infection control patient risks using a color-coded system to assist maintenance staff in assessing the impact that maintenance work may have in the risk areas mentioned above. The problem was pointed out by a mock environment of care inspection in preparation for a Joint Commission visit; the facility's Director and Associate Director wanted a system redesign after the findings.

Significance:

Health care facilities will continue to see and treat a large variety of patients, each with a different condition or illness. These illnesses or conditions make the patients of the facility more susceptible to the risks generated through maintenance activities through the work orders that take place throughout the facility. For example, a 2006 study that aimed to summarize the data from all *Aspergillus* outbreaks reported to date (Vonberg & Gastmeier, 2006), found 53 outbreaks that affected 458 patients. Because of the risk to patients, serious precautions must be taken once maintenance staff know the location and type of work that is to be accomplished. Infection Control nurses are concerned with preventing the spread of infections in the medical facility, and some of the same skills are required of the crafts and trades within a Hospital.

Immunocompromised is the condition in which the body's immune system is impaired or weakened and cannot easily fight infections. Patients with a compromised immune system are at high risk of infection due to the inability for their immune system to fight off infections

Some examples of immunocompromised patients are:

1. Newborns
2. A patient who is terminally ill
3. A patient on dialysis or a ventilator
4. A patient with open wounds or burns
5. A patient with any existing condition or disease

Any patient who is considered immunocompromised is more vulnerable to a healthcare-associated infection. These types of infections are related to being treated at a health care facility and become secondary to the primary reason for being treated.

Understanding and being aware of the potential hazards that are associated with the areas of the health care facility that may have these immunocompromised patients is essential to minimizing the risk of causing a healthcare-associated infection. The need to protect staff, patients, and visitors to the facility through a process that aims to reduce or eliminate the risk for these types of infections to be spread through the work order process is critical to safety.

Having a work order process in place that aids in identifying these risks through blueprints, workers that understand the process, and a process that has checks and balances in place to aid both supervisors and workers to understand and implement the correct control measures is paramount to being successful in minimizing the risks.

Literature Review:

According to Nicolle (2000), infections are common in health care facilities. The most frequent endemic infections are urinary, respiratory, skin, and soft tissue infections. Outbreaks and a significant occurrence of colonization of residents with antimicrobial-resistant organisms also occur far too often. Our understanding of viruses and the development of infection-control programs for health care facilities has progressed dramatically over the past twenty years. As diseases continue to evolve throughout the years, a new focus on minimizing the spread and control through facilities construction work has been a high priority in health care facilities. Documenting whether infection control personnel have been involved in all phases of construction, renovation, and demolition is a top priority (CDC, 2003). The environment of care rounding's of The Joint Commission gives an extensive look at engineering control concepts that are needed in health care facilities (CDC, 2003). According to The Infection Prevention Manual for Construction & Renovation (2015), about 5% of infections are due to hospital construction and maintenance activities, and those infections from construction cause about ninety-nine thousand deaths annually. Both indoor and outdoor construction activities produce airborne dust and debris that can carry microorganisms into the health care facility, directly impacting patient care areas. The Joint Commission's Comprehensive Accreditation and Certification Manual updated the standards to include Environment of Care (EC) and Life Safety (LS) Chapter Revisions for the Life Safety Code Update (2017).

"Create a procedure so that maintenance staff evaluate the impact of the following items whenever maintenance activities (unscheduled work orders) are performed: 1) noise; 2) air quality; 3) vibration; 4) interim life safety measures; 5) infection control; 6) utility failures, and; 7) emergency procedures. (EC.02.05.05, EP1; EC.02.06.05, EP)."

This update in standards created the need to either revise every work order form to create a process that includes all of the seven items listed above, or to establish a policy that describes how maintenance staff should evaluate each of the issues and indicate actions taken in a "comments" box. The Guidelines on Core Components of Infection Prevention and Control Programs identifies ten critical components to an active infection prevention program with targeted surveillance being a top priority. It is important to note that the agency observed for this paper was properly and successfully documenting the other six items, but not infection control.

The Department of Labor (DOL) and the Occupational Safety and Health Administration (OSHA) have both come together to define that maintenance is only governed under general industry standards (DOL, 2003). “Construction” and “Construction work” are defined in § 1910.12(b) and § 1926.32(g) as "work for construction, alteration, and repair, including painting and decorating" (DOL, CFR). Although there is no regulatory definition for "maintenance," an OSHA letter of interpretation from November 18, 2003, defines "maintenance" as “making or keeping a structure, fixture, or foundation (substrates) in proper condition in a routine, scheduled, or anticipated fashion.” An employer should make the distinction between construction and maintenance on a case-by-case basis. Kee Safety (2005).

Kee Safety (2005) states the following regarding Construction vs. Maintenance: The following are examples set forth by OSHA to help distinguish between construction and maintenance: The scale and complexity of the task (large scale tasks and objects indicate structure). In a letter date from 2003 from OHSA to a company in Pittsburgh, PA OHSA stated the following;

“*Unlike construction work, there is no regulatory definition for "maintenance," nor a specified distinction between terms such as "maintenance," "repair," or "refurbishment." "Maintenance activities" have commonly been defined in dictionaries as making or keeping a structure, fixture or foundation (substrates) in proper condition in a routine, scheduled, or anticipated fashion. In OSHA's directive on the general industry confined space standard, the Agency stated that maintenance involves "keeping equipment working in its existing state,* i.e.*, preventing its failure or decline"*[3] *[emphasis*

added]. In applying this concept to the broad range of circumstances encountered in the construction industry, the factors discussed in the Tindell *and* Ellis *letters and those discussed below must also be considered*"

Construction work is not limited to new construction but can include the repair of existing facilities or the replacement of structures and their components. For example, the replacement of one utility pole with a new, identical pole would be maintenance; however, if it were replaced with an improved pole or equipment, it would be considered construction.

Taking into consideration multiple concepts such as materials and the duration of time required to complete the job. Kee Safety (2005) uses as an example, the replacement of a steel beam; the project would be considered a construction repair rather than maintenance because of the replacement project's scale and complexity if the tasks improve the original condition or preserve it (improvement indicates construction, preservation indicates maintenance). Construction work is not limited to new construction but can include the repair of existing facilities or the replacement of structures and their components.

The Joint Commission stated, in a November 2019 newsletter, that a pre-construction risk assessment (PCRA) is a multidisciplinary process to assess the potential environment of care, infection prevention, and life safety codes and control risks associated with planned or unplanned construction, renovation, demolition, or maintenance/repairs in or contiguous to a health care environment. This assessment focuses explicitly on patients and other occupants. An infection control risk assessment (ICRA), which is part of the PCRA process and also required by The Joint Commission, takes into account the environment, work practices, patient populations, and infectious agents associated with a proposed project and physical environment activity, as well as the action that needs to be taken before the work to mitigate risk. The ICRA process needs to start as soon as possible when construction, renovation, demolition, or maintenance/repairs are in the planning stages to identify any changes to design based on the patient population of the unit and intended clinical applications.

The Center for Disease Control (2003) and The Joint Commission (2019) both state: Some major critical control points in the ICRA process include dust mitigation, proper ventilation, prevention of surface-borne contamination, and clean construction practices. These all include HEPA filters, tools, and ways to clean the air in the space. Before performing maintenance work, any in-house maintenance team needs to proactively participate in the ICRA process so that all critical patient protection (ICRA plastic or hard barriers) measures to prevent possible contamination are in place. Maintenance in a health care setting is classified as construction even though OSHA allows it to be classified under general industry standards. In December of 2019, The Joint Commission outlined the PCRA (Appendix A) and ICRA (Appendix B) processes as being required for hospitals, ambulatory health care centers, behavioral health care centers, and nursing care centers.

Personal protective equipment typically includes hearing protection and eye protection intended to protect the wearer in smaller shop settings. In contrast, patient protective apparel is worn to prevent contaminants from transferring from workers to patients. Some examples of patient protective clothing are:

- Hair and beard nets
- Surgical masks
- Nitrile gloves (some applications require double pairs)
- Shoe covers
- Scrubs (disposable jumpsuits)

These items are needed in critical areas identified by the infection control risk assessment. Not only are they required in these areas, but the requirement also ensures that in those situations, the staff will wear them while performing their respective trades' work. Also, before leaving will safely remove them in an anteroom when the infection control risk assessment designates this requirement. The environment of care rounding's of The Joint Commission gives an extensive look at engineering control concepts that are needed in health care facilities (CDC, 2003). According to The Infection Prevention Manual for Construction & Renovation (2015), about 5% of infections are due to hospital construction and maintenance activities, and those infections from construction cause about ninety-nine thousand deaths annually.

A pre-construction risk assessment with an infection control risk assessment can be found in the appendix section of this document. The Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings (2007) has listed the isolation areas and the guidelines on how to minimize the risk of infection spreading through the use of hard and soft barriers. With the updated Joint Commission requirements having an in-depth look at how each work order can be addressed with a PCRA and ICRA it is critical to ensure the health care facility is doing its part in minimizing the risk associated with infection control. The cost associated with having the correct tools, having the right barriers, and having the areas in the health care facility identified all play a critical factor in allowing the facilities staff to do their part.

Purpose:

Through the completion of this project, a system redesign for the work order process will include: the identification of risks associated with maintenance work orders (ICRA Stamp, Blue Prints, and Tool Cart), and well as identifying specific procedures for staff to mitigate the risk once it has been identified (SOP). The measures include; identifying a multi-disciplinary team, training staff, identifying tools and prices, and placing items to ensure timely resolution. After completing these items, a best practice guide with prices will be available to understand better the financial impacts to a hospital for ensuring the infection control process is followed. Appendix C and D show a fishbone diagram and action items with the expected outcome.

Definitions:

Airborne: moved through or by air.

Anteroom: a contained area that separates the work area from the clean patient-occupied positive air space.

CMMS- Computer Maintenance Management System: software used to track and implement preventative maintenance as well as work order function for a facility.

HEPA- High-Efficiency Particulate Air Vacuum Cleaner: used on outside of the contained work area to catch and filter contaminates.

Infectious agent: A biological substance capable of transmitting disease.

Infection Control: discipline concerned with preventing the spread of infections within a health care facility.

PPA- Patient Protective Apparel: anything worn by a worker to prevent the transferring of contaminants from the worker to the patient.

Assumptions:

The following hypotheses will be given for this project:

1. The infection control risk assessment process described is specific to the hospital observed for this project. It cannot be deemed acceptable to other hospitals or health care facilities without a full review of the type of care offered at that facility.
2. Prices listed will only be good for thirty to ninety days from the given quote for all products listed. Appendix E

Scope:

The completion of this project was for five months. Preliminary work was conducted before the start of the semester to include blueprint identification, tools and supplies needed, training needs of facility staff, and weekly stakeholder meetings. The blueprint identification is to streamline identifying areas in the hospital in color, so workers understand and know the risk and level that they carry prior to starting work. Depending on the type of work and risk the area carries certain rooms will start off as a class three or four no matter what type of work someone is completing. Tools and supplies for higher areas are specialized and barriers need to be placed to mitigate dust migration to other areas of the hospital. The tools and supplies are to mitigate the risk and enable workers to be properly prepared to work in these areas safely, effectively and efficiently.

Due to the complexity of the work in this study, the work will be split into some data about the work order process being collected during work and processing after work. The meetings needed with other staff, peers, and subordinates will be conducted during

working hours. During the meetings we will split up work assignments and how to share once complete, what are best practices and how to implement them effectively into the facility. The end product will be a work order redesign that compliments the work order process while minimizing the risk of infections spreading, ensuring proper documentation and training of all facilities staff. That will include-

1. An ICRA classification stamp will be procured for Facilities so that all work orders can be marked appropriately to the level of ICRA classification for that work.
2. 100% update to the work order policies to include procedures to follow when there is maintenance (work orders) that may impact noise, air quality, vibration, interim life safety measures, **infection control**, utility failures, and emergency procedures.
3. 90% of Facilities personnel involved in the work order process will receive Construction ICRA Best Practices in Healthcare Construction Training.
4. 100% complete sets of blueprints identifying patient risk levels for the rooms in all patient care buildings will be obtained.

Methodology:

Having a holistic approach to the work order redesign will enable the closing of the loop and allow for continuous improvement to take place. Utilizing Six Sigma and Lean concepts will help pave the way for a sustainable process moving forward. The first steps are to set up who the project owner is going to be, then identifying the diverse group of staff that will be willing to shed some light and experience onto the project. The reason for bringing in a complex team and distinct group is to ensure we have people from all trades present and staff from the multiple fields throughout the hospital to ensure we are not missing anything. Below is what the project team identified-

- In Project Scope: All work orders that have an infection control or safety aspect to them.
- Out of Scope: Work orders not directly related to maintenance or construction.
- Process Start: Work Order requests requiring maintenance and repair of a building or building utility system.
- Process Stop: Completion of Work Order that involved maintenance and repair of a building or building utility system.

Having a weekly meeting and giving out assignments that need to be completed and compiled before the following sessions will prove to be valuable to continue to keep the project moving forward and on time. Understanding what the facility needs for work orders is the next step.

When entering a Work Order, it is essential to provide as much information as possible to ensure accurate work is completed. Work orders requiring maintenance or repairs from more than one trade or group and jobs covering multiple room locations require separate work orders. While Emergency Work Order requests are to be made directly to the Work Order Clerk, a follow-up work order is expected to be entered in the CMMS by the requester. Emergency Work Orders will be completed or downgraded within one (1) workday of being introduced. The shop supervisor will contact the original requestor stating the reason for work order downgrades. High Priority work order requests should be called into the Work Order Clerk at submission into the CMMS. This allows personnel to verify the validity of the request. The original work order requestor will be contacted by the responsible shop supervisor stating the reason for the downgrade or if the work order cannot be closed within one (1) week. Figure one below shows the current work order flow state, Figure two below shows the Future procedure work order flow chart number one, and Figure three shows the future procedure work order flow chart number two.

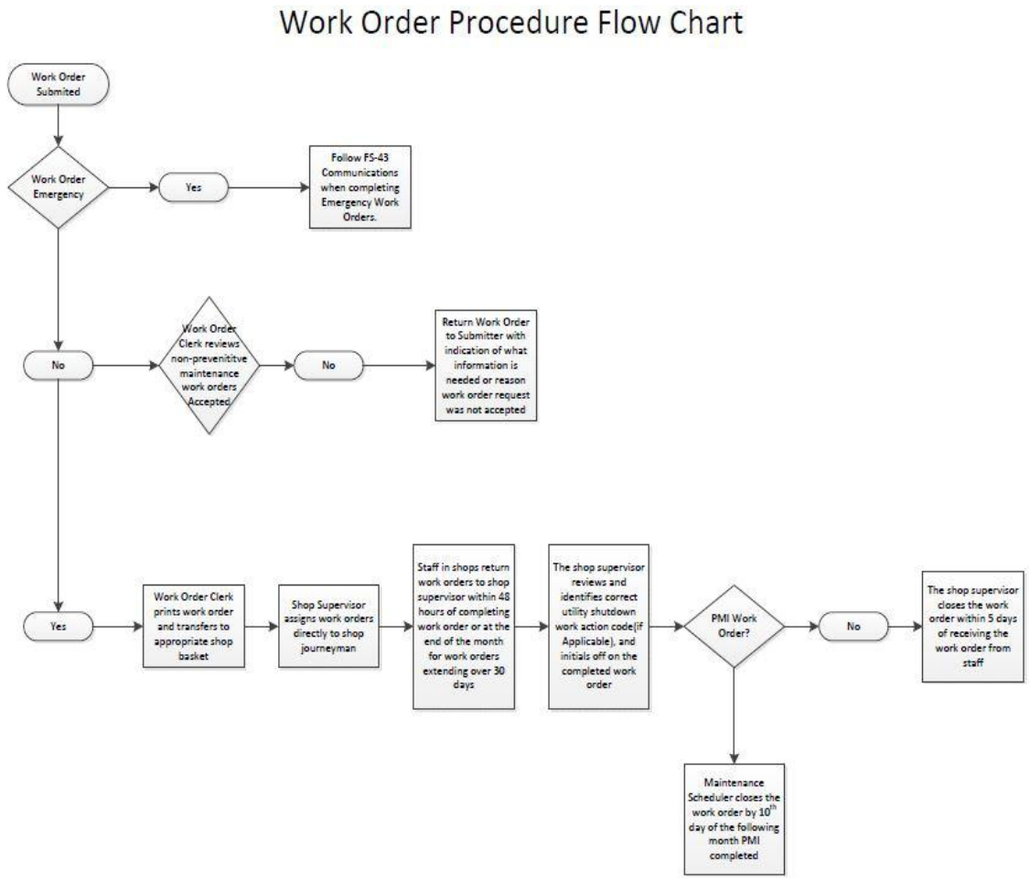


Figure 1: Current Work Order Flow Chart

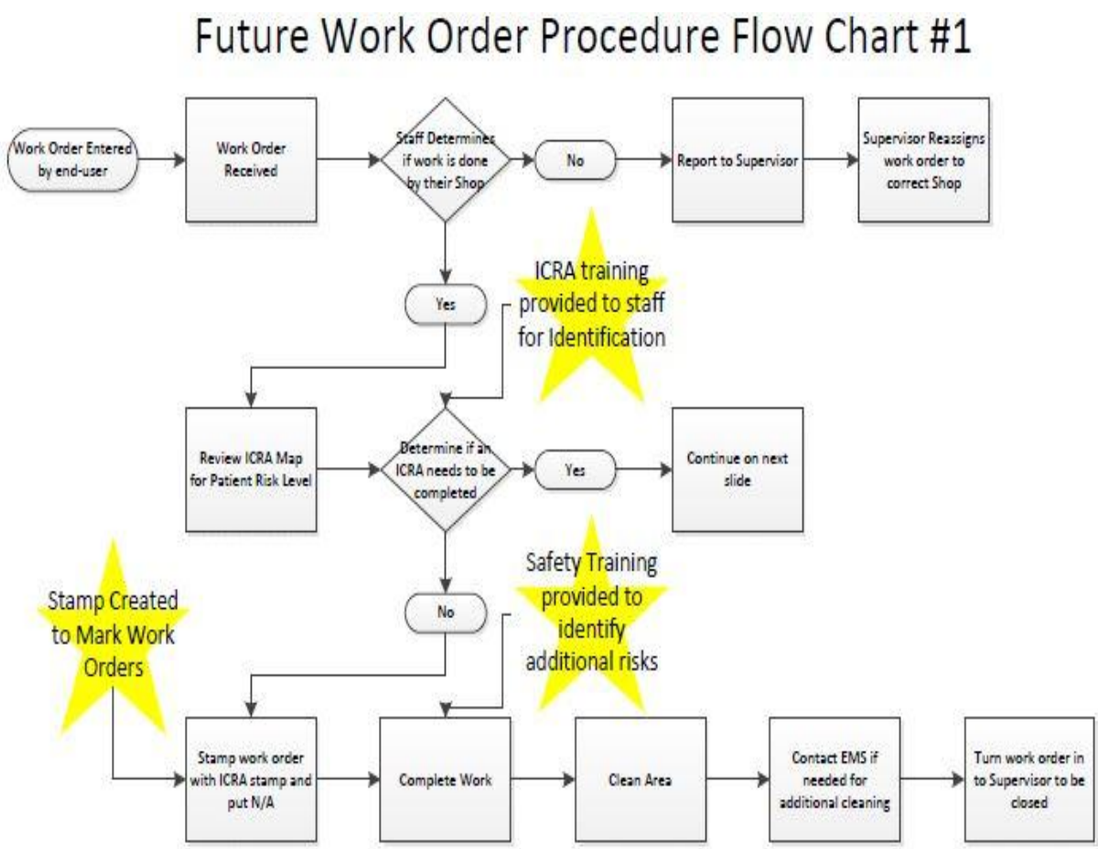


Figure 2: Future work order procedure flow chart number one

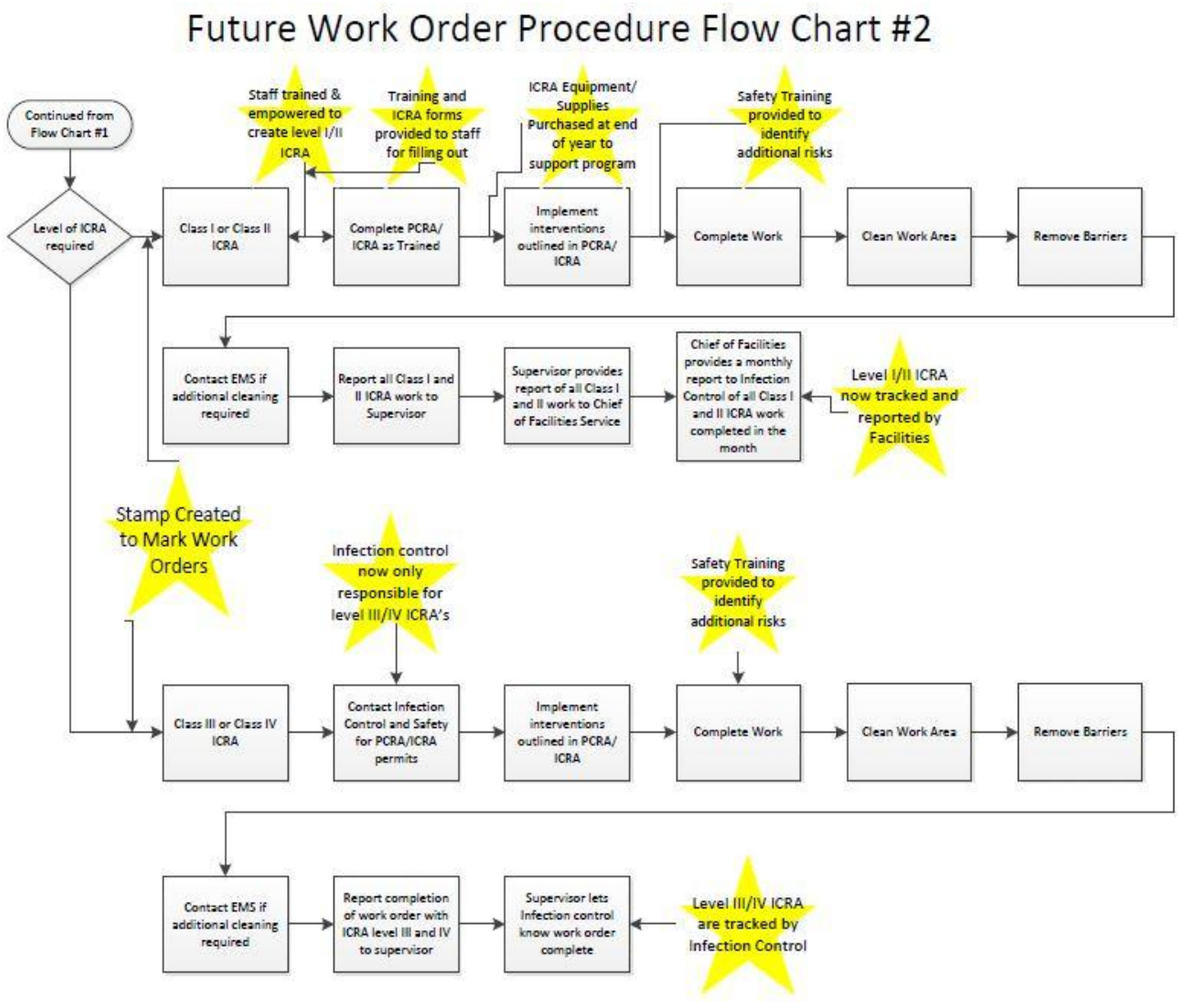


Figure 3: Future work order procedure flow chart number two.

Using process improvement can eliminate a lot of unnecessary steps and waste from any process. By conducting a GAP analysis, we can better understand the deficiencies in the process and how fixing them can better serve The Joint Commission requirements. Appendix: F is the gap analysis for this project.

Understanding the steps and how to use the ICRA Risk: after looking at what type of work needs to be done, Appendix B. identifies the types of work A-D (figure 4 below). Once the worker knows what type of work they will be doing, they need to know the location and the risk carried in that location. Figure five below shows the risk levels and areas in the hospital that carry those respective risks.

Type A	**Inspect and Non-invasive Activities:** Includes, but not limited to: **<u>Removal of ceiling tiles for visual inspection limited to 1 tile per 50 square feet</u>** Painting (but not sanding) Wallcovering, electrical trim work, minor plumbing, and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection
Type B	**Small scale, short-duration activities which create minimal dust:** Includes, but not limited to: Installation of telephone and computer cabling Access to chase spaces Cutting of walls or ceiling where dust migration can be controlled

Type C	**Work that generates a moderate to a high level of dust or requires demolition or removal of any fixed building components or assemblies:** Includes, but not limited to: Sanding of walls for painting or wall covering Replacement of floor covering, ceiling tiles and casework New wall construction Minor ductwork or electrical work above ceilings Major cabling activities Any activity which cannot be completed within a single work shift
Type D	**Major demolition and construction projects:** Include, but not limited to: Activities that require consecutive work shifts. Requires massive demolition or removal of a complete cabling system. New construction

Figure 4: Type of work to be performed

Low Risk	Medium Risk	High Risk	Highest Risk
Office areas	Cardiology Echocardiography Endoscopy Nuclear Medicine Physical Therapy Radiology/MRI Respiratory Therapy	CCU Emergency Room Laboratories Outpatient Surgery Pharmacy Post-Anesthesia Care Unit Surgical Units	Any area caring for immunocompromised patients Cardiac Cath Lab Central Supply Intensive Care Units Medical Units Negative airflow rooms Oncology Operating Rooms

Figure 5: Types of Risk and Area

Once you have the type of work and the risk identified you can now look at the matrix and identify the classes of ICRA you will need. Figure six below shows the type and class matrix. Example: using Figure four, we will be doing some sanding of walls for painting, which is type C. The area in which we will be doing the sanding and painting is an office area. The office area carries a low risk on the risk chart in Figure 5. If we use the infection control risk matrix provided in Figure 6, we can see that a type C work that carries a low risk is a Type two ICRA.

Patient Risk Group	**Type A**	**Type B**	**Type C**	**Type D**
Low risk	I	II	II	III/IV
Medium risk	I	II	**III**	**IV**
High risk	I	II	**III/IV**	**IV**
Highest risk	II	**III/IV**	**III/IV**	**IV**

Figure 6: Infection control Risk Matrix

Figure 7 below shows class three and class four ICRA's and the type of precautions that must be taken when maintenance personnel are working in these areas. These two levels are required in the highest risk areas of the hospital and require a higher level of hard barriers and cleanliness to avoid dust migration to other areas of the hospital as well as possible cross contamination. The use of HEPA filters, while employees wear proper gowns and booties, as well as having anterooms established to allow for proper donning and undressing procedures. The anteroom is a negative pressure room that creates a clean area for staff, tools and materials to be cleaned and safely pass between the work area and the open areas of the hospital.

Class III	1. Remove or isolate the HVAC system in an area where work is being done to prevent contamination of the duct system. 2. Complete all critical barriers, i.e., sheetrock, plywood, plastic, to seal area from the non-work area or implement control cube method (cart with plastic covering & sealed connection to the worksite with HEPA vacuum for vacuuming before exit) before construction begins. 3. Maintain negative air pressure within the worksite, utilizing HEPA-equipped air filtration units. 4. Contain construction waste before transportation in tightly covered containers. 5. Cover transport receptacles or carts. The tape covering unless the solid lid is used.	1. Do not remove barriers from work area until the completed project is inspected by Safety Management & Infection Control & thoroughly cleaned by Environmental Management. Ceiling system and tiles must be in place before barriers are removed. 2. Remove barrier materials carefully to minimize the spreading of dirt & debris associated with construction. 3. Vacuum work area with HEPA-filtered vacuums. 4. Wet mop with disinfectant. 5. Remove isolation of the HVAC system in areas where work is being performed.
Class IV	1. Isolate the HVAC system in an area where work is being done to prevent contamination of the duct system. 2. Complete all critical barriers, i.e., sheetrock, plywood, plastic, to seal area from the non-work area or implement control cube method (cart with plastic covering & sealed connection to the worksite with HEPA vacuum for vacuuming before exit) before construction begins. 3. Maintain negative air pressure within the worksite, utilizing HEPA-equipped air filtration units. 4. Seal holes, pipes, conduits, and punctures appropriately. 5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving worksite, or they can wear cloth or paper coveralls that are removed each time they leave the worksite. 6. All personnel entering the worksite are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. 7. Do not remove barriers from work area until the completed project is inspected by Safety Management & Infection Control & thoroughly cleaned by Environmental Management.	1. Remove barrier materials carefully to minimize the spreading of dirt & debris associated with construction. 2. Contain construction waste before transport in tightly covered containers. 3. Cover transport receptacles or carts. The tape covering unless solid lid. 4. Vacuum work area with HEPA-filtered vacuums. 5. Wet mop with disinfectant. 6. Remove isolation of the HVAC system in areas where work is being performed.

Figure 7: Class three and four ICRA Measures.

Results:

As work orders came into the CMMS for the facility observed for this project, they were reviewed by the work order clerk using the new ICRA Maps (Appendix H shows the full layout of the campus and also one floor for a building all data is missing due to security measure and protection of the facility).The clerk then identified the area of the hospital that the work was to be completed in. Each work order was stamped with a class three or four and distributed to the supervisor to meet with safety and infection control staff to ensure the correct barriers were in place prior to work being completed. Work orders in areas that are class ones and or twos the technician is not required to have an ICRA posted per the updated policy. Figure eight below is the stamp in action.

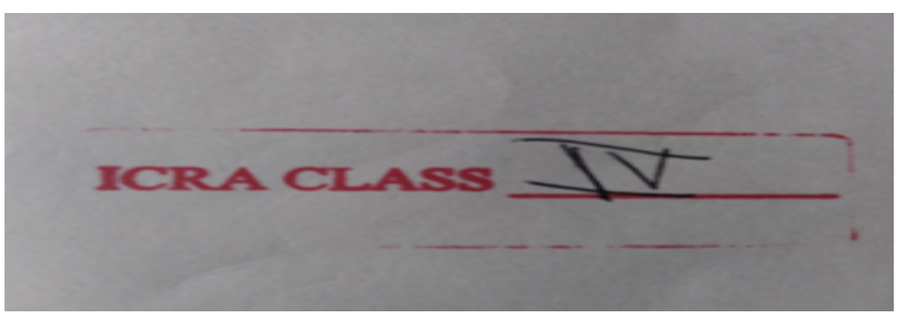


Figure 8: Work order stamp showing ICRA Class IV

Having weekly meetings with stakeholders to discuss assignments and getting to the roots causes of the infection control issues was how the team came up with the problem statement, fish bone diagram (Appendix C), Action items (Appendix D) as well as the root causes in Appendix F. Early on it was critical to understand from the maintenance technicians how the system redesign could help them understand and implement better infection prevention measures. One item that was brought up was to have carts strategically placed throughout the hospital that had specialized tools. Each supervisor would have keys that could be issued out for infection control use only. Appendix F is a cost of each cart with a breakdown of the tools and equipment required for each cart as identified by the technicians, supervisors, and infection control staff. The total for each cart was $33,978.48. These specialized carts and tools are in place to ensure rapid and safe responses in these critical areas.

After putting together the fishbone diagram it was clear that the facility had a deficiency in staff training and understanding related to how and when each classification worked and what was needed to be successful. After contacting the carpenters Union, they were able to come out for free on multiple occasions to train all the facilities staff. Appendix G is the flyer that was created for one of the days of training. The training was eight hours and covered awareness, administrative controls, protocols, and how to control contaminants. The Union does have a forty-hour long course; however, it is only offered for carpenters and no other trades are allowed to attend. Once the facility had all the staff trained in the eight-hour course, it updated the policy for infection control in the medical center to create better understanding and to minimize risk through the new work order process.

Stac Systems were used for hard barriers due to the products exceeding the ICRA class four requirements, exceeding the ASTM E-84 for smoke and fire spread, and having a fast installation time. Appendix I shows the barriers installed in different hospitals and Appendix J shows the quote for this project for two carts and two of the same types of barriers; the total for these two is $9,999.31.

The total cost for tools and equipment, the barriers and the ICRA Stamp is listed below in the table one.

Project Costs	
Tools & Equipment	$ 33,978.48
Barriers	$ 9,999.31
ICRA Stamp	$ 15.00
Total	$ 43,992.79

Limitations:

The following limitations have been considered as issues that can arise in this project; type of health care facility (Services provided), Management buy-in, and financial limitations for tools, etc. Each health care facility can provide a multitude of different services which may have an impact on how to address infection control measures. The department of Veteran Affairs has a three-tier system, one being the most extraordinary and most services provided, two and then three being the smallest with fewer facilities and typically in rural areas. Understanding that some CMMS is extremely outdated, and this can drastically limit the ability to complete items and provide upward reporting promptly.

Conclusion:

Creating ICRA Risk level Blueprints of buildings and rooms assisted facilities staff in determining patient risk level for work in areas, the need to create ICRA's carts to facilitate the work and implement proper precautions through better procedures. Creating a new and updated standard operating procedure for the ICRA process related to Work Orders will aid in getting the facilities staff to use proper ICRA precautions when doing work moving forward. Educating the facilities staff on ICRA/PCRA process was identified early on and led to the carpenter's union's participation for all staff as well as future plans to continue to send staff to the training. It also allowed the facility staff to complete class work orders that require minimal barriers and safety measures. One of the larger issues that was identified was the need to have an improved ability of facilities to meet ICRA containment requirements. This was accomplished by purchasing supplies and materials to meet barrier requirements outlined in ICRA. Appendix I and J are the hard barriers and quote that exceed ICRA Level four requirements. During the processes it was identified that dedicated toolboxes and tools should be purchased for rapid deployment for

emergencies and level three and four ICRA placement. Figure nine and ten below are photos of the carts.

Figure 9: ICRA Cart

Figure 10: ICRA Cart

Once everything was in place, there was a continued need to educate general staff on the work order process to improve quality of work orders going to Facilities staff, and

reduce time lost finding out additional details. The training through education was not only through the carpenter's union. The carpenter's union training was instrumental in bridging the gap between the workers and infection control staff. Infection control staff held training monthly for a few hours and the maintenance Foremen held risk assessment training on the same basis. Attention to detail related to infection prevention improved as the staff received more education and became more involved in the process. The infection prevention staff allowed the maintenance staff to be actively involved and to have their ideas heard, making maintenance staff willing to give more back to the process.

During the project, three rapid experiments were conducted to allow for implementation to achieve function for this process. The experiments were selected randomly each time from the work order system without any prior knowledge except from infection control staff and the Maintenance Foreman. The first experiment was conducted on January 10th, 2020, the second on February 28th,2020, and the third on March 13th, 2020. Figure eleven below is test one, Figure twelve below is test two, and Figure thirteen is test three.

1/10/20	**PDSA Test #1**
Plan: Plan the test or observation.	To identify and implement proper Infection Control preventive methods for flooring work in Urgent Care
Do: Try out the test on a small scale.	Staff used the ICRA to put in place the precautions they thought were correct.
Study: Analyze the data/ study the results.	Facilities staff attempted to start work outside of the time that was selected. Infection control was only aware of the issue due to having been in the area at the time the Facilities staff were attempting to set up barriers
Act: ** Adapt, Adopt, Abandon? Refine the change, based on what was learned from the test	Adapt, ensure construction safety rounds are also occurring for work order related repairs for class III and IV ICRAs by adding these to the weekly Construction Safety Rounds

Figure 11: Test one

2/28/20	**PDSA Test #2**
Plan: Plan the test or observation.	To Identify and Implement proper Infection Control Preventive methods for Countertop work in Pharmacy
Do:	Staff used the ICRA to put in place the precautions they thought were correct.

Try out the test on a small scale.	
Study: Analyze the data/ study the results.	Facilities staff set up barriers as outlined in the ICRA and communicated with Infection Control during work.
Act: ** Adapt, Adopt, Abandon? Refine the change, based on what was learned from the test	Adopt, Great communication by all involved and proper equipment used and setup correctly.

Figure 12: Test two

3/13/20	**PDSA Test #3**
Plan: Plan the test or observation.	Facilities staff to identify and implement proper Infection Control preventive methods for emergency level I or II work for themselves
Do: Try out the test on a small scale.	Facilities staff used ICRA to identify the proper classification of the ICRA and what equipment was needed without Infection Control staff input.
Study: Analyze the data/ study the results.	Facilities staff did a great job of communicating the situation along with identifying the proper level of ICRA needed and implementing proper precautions
Act: ** Adapt, Adopt, Abandon? Refine the change, based on what was learned from the test	Adapt, Facilities staff handled the situation perfectly.

Figure 13: Test three

During each test the maintenance staff continued to receive more training and policies continued to be updated. During the three-month duration of the tests, progress was documented. During test one, the facilities staff attempted to start work outside of the time that was selected. Infection control was only aware of the issue due to having been in the area at the time the facilities staff were attempting to set up barriers. Test two showed more steps in the right direction. Facilities staff set up barriers as outlined in the ICRA and communicated with Infection Control during work. During test three, facilities staff handled the situation perfectly.

Moving forward- a finding that would add value would be to have a way to implement tracking of work orders for each level of ICRA to assist with making sure that proper precautions are being implemented by having a way to assess the effectiveness of the interventions. Figure 14 shows how the Foreman will track all ICRA levels each month while the infection control staffing will track the quarterly work orders with infection control levels. This information will prove to be valuable to further understand

the time it takes to set up, clean and restore spaces back to use within a health care facility, and the staffing needed to ensure proper infection control measures are being followed.

	METRIC	TARGET VALUE	DATA SOURCE	WHO COLLECTS	HOW OFTEN	COLLECTION METHOD	REVIEW FREQUENCY	RESULTS SHARED HOW?
SUSTAIN	Classification Level I&II ICRA's	100% Count of all Level I&II ICRA's done for work orders	Work Orders	M&O Foreman	Once a Month	Manually	Once a Month	VIA collection form through email to Infection Control
SUSTAIN	Classification Level I, II, III, &IV ICRA's	100% of reported and completed ICRA's	Spread Sheet	Infection Control Team	Quarterly	Manually	Quarterly	VIA report

Figure Fourteen: Future Data Collection

References:

Lindsay E. Nicolle. (2000) Infection Control in Long-Term Care Facilities. Retrieved from: https://academic.oup.com/cid/article/31/3/752/297815

Guidelines for Environmental Infection Control in Health -Care Facilities (CDC) (2003). Retrieved from: https://stacks.cdc.gov/view/cdc/45796

Infection Prevention Manual for Construction & Renovation. Association for Professionals in Infection Control and Epidemiology. (2015) Retrieved from: https://apic.org/?id=b418d326-d4dc-4f91-a627-7106da3b30ad

The Joint Commission Comprehensive Accreditation and Certification Manual, Retrieved From: http://e-dition.jcrinc.com/ProxyLogin.aspx?lnk=2293FDDF5458.

The Joint Commission (TJC) (October 2016). Retrieved from: https://www.jointcommission.org/-/media/deprecated-unorganized/imported-assets/tjc/system-folders/topics-library/prepub_lifesafetycode_disposition_hap_v2pdf.pdf?db=web&hash=7595833DB474281654FD37D932F2024E

Guidelines on Core Components of Infection Prevention and Control Programmes at the National and Acute Health Care Facility Level. (2016). Retrieved from: https://apps.who.int/iris/bitstream/handle/10665/251730/9789241549929-eng.pdf

Department of Labor (DOL, 2003) Retrieved from: https://www.osha.gov/laws-regs/standardinterpretations/2003-11-18

Department of Labor (DOL, CFR) retrieved from: https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.12

Construction vs. Maintenance, Kee Safety (2005) Retrieved from: https://www.keesafety.com/news/construction-vs.-maintenance-do-you-know-which-osha-standards-apply

The Joint Commission (TJC), EC News. (November,2019) Volume 22, Issue 11. Retrieved From: http://vaww.oqsv.med.va.gov/functions/integrity/accred/accredNewsletters.aspx

The Joint Commission (TJC), EC News. (December 2019) Volume 22, Issue 12. Retrieved From: http://vaww.oqsv.med.va.gov/functions/integrity/accred/accredNewsletters.aspx

Pre-Construction Risk Assessment and Infection Control Risk Assessment (ICRA) Matrix. Retrieved From: http://www.cce-inc.com/safety/forms/19.1.4%20Pre-Construction%20Risk%20Assessment.pdf

CDC. Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007. Retrieved From: https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html

W.R Jarvis (2001). Infection control and changing health-care delivery systems. Retrieved From: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2631740/

Judene Mueller Bartley MS. APIC State-of-the-Art Report: The role of infection control during construction in health care facilities. American Journal of Infection Control Volume 28, Issue 2, April 2000, Pages 156-169. Retrieved From: https://www.sciencedirect.com/science/article/abs/pii/S0196655300900245

Current views of health care design and construction: Practical implications for safer, cleaner environments. American Journal of Infection Control Volume 38, Issue 5, June

2010, Pages S1-S12. Retrieved From: https://www.sciencedirect.com/science/article/abs/pii/S0196655310004074

Pual Walley, Kate Silverster, Shaun Mountfrod. Health-care process improvement decisions: a systems perspective. International Journal of Health care quality Assurance. January 2006. Retrieved From: https://www.emerald.com/insight/content/doi/10.1108/09526860610642618/full/html

D. Clair, Jeffrey; Colatrella, Sandie. Opening Pandora's (Tool) Box: Health Care Construction and Associated Risk for Nosocomial. 2013. Retrieved From: https://www.ingentaconnect.com/content/ben/iddt/2013/00000013/00000003/art00005

Donald J. Garvey, 2002. Safety and Health Considerations for Construction Safety Professionals During Renovations in Medical Facilities. Retrieved From: https://www.onepetro.org/conference-paper/ASSE-02-702

Cacciari P, Giannoni R, Marcelli E, Cercenelli L. 2004. Considerations on isolation rooms and alternative pressure ventilation systems. Retrieved From: https://europepmc.org/article/med/15697008

Titus L. Daniel, Thomas R. Talbot 2014. Infection Control and Prevention Considerations. Retrieved From: https://link.springer.com/chapter/10.1007/978-3-319-04220-6_15

Andrew N. Baldwin, 2003. INFECTION CONTROL WITHIN THE BUILT ENVIRONMENT. Retrieved From: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.536.6646&rep=rep1&type=pdf

United States Department of Labor, Occupational Safety and Health Administration.(2003) Retrieved From: https://www.osha.gov/laws-regs/standardinterpretations/2003-11-18

M. T Hedayati, A. C Pasqualotto, P. A Warn, P Bowyer, D. W Denning,(June, 2007).Aspergillus flavus: human pathogen, allergen and mycotoxin producer. Retrieved From:https://www.microbiologyresearch.org/search?value1=M.+T+Hedayati&option1=author&noRedirect=true

Appendix: A

Pre-Construction Risk Assessment (PCRA)

Project:	**Location(s):**	**Start Date:**
COR:	**Contractor:**	

Brief Description of Work:

Updates/changes to project will be brought to Safety for revision of PCRA.

Category	Factors	YES	N/A	Initials
Noise *Industrial Hygienist (IH)	Impact, Duration			
Vibration *Industrial Hygienist (IH)	Tool use, Demolition, Distance			
Infection Control *Infection Control Coordinator	Category of Risk [1] see below Level: I - II - III - IV			
Dust *Infection Control Coordinator	Cutting, Grinding, Sanding, etc.			
Life Safety Impact *Fire Department	ILSM Issues: [2] – see below			
Security *Chief, Police Service	Site Security, Access Control			
Disruption of Utilities *COR - Facilities	Planned Shutdowns, Construction Near Utility System Supplies			

[1] Infection Control Risk Assessment (ICRA) is for evaluation of the level of practices necessary to provide appropriate levels of patient safety.

[2] ILSM Risk Assessment is for determining whether ILSM are necessary and which ILSM are to be implemented.

Other Risk Assessments:	YES	N/A
Permit Required Confined Space (PRCS) entry will be necessary. ***IH**		
Asbestos/lead or another hazardous abatement will be necessary. ***IH**		
Construction debris will be produced. (Recycling Program) ***GEMS**		
Chemicals will be on site. (Hazard Communication/SDS sheets necessary.) ***IH**		
Compressed gas cylinders will be on site. (Appropriate storage) ***IH**		
Penetration in floors, walls, ceilings will be necessary. (Permit required) ***FD**		
Cutting, burning, or welding will be necessary. (Hot Work Permit) ***FD**		
Off tour, construction/work will be necessary. (Supervision) ***FD**		
Lock-Out/Tag-Out of the following systems be necessary: ***Facilities.** Domestic Water **X** Electrical Systems **X** HVAC System Medical Gas Steam Systems Security Alarms IT Systems		

Safety Manager **COR** **Date**

Concerns to address:	Measures to take:

Impact of Building Trades on Healthcare

System	Possible Interruption	Possible Effect to Patients
Electrical	**- Changing the position of switches and breakers** **- Cutting or splicing into wires** **- Disconnecting wires or terminals** **- Disturbing Junction Boxes/Electrical Panels** **- Core Drilling** **- Demolition of walls** **- Excavation**	**Electrical Systems provides LIFE SUPPORT (Directly and Indirectly)** **- Can cause DEATH to patients**
Water Lines	**- Turning valves** **- Cutting into lines** **- Demolition & Excavation**	**HVAC, GPICU, X-Ray, etc.** **Can cause DEATH to patients** **Infection Control issues** **Major Cleanup issues**
Medical Gases: **Oxygen** **Air** **Vacuum** **Nitrous Oxide** **Nitrogen**	**- Cutting or disturbing into lines (labeled, unlabeled)** **- Changing valve positions** **- Deactivating alarms** **- Demolition & Excavation**	**Loss of Oxygen, vacuum, air, etc.** **Can cause DEATH to patients**
HVAC	**- Shutting down** **- Modifying** **- Changing controls** **- Cutting into the roof** **- Producing foul odors near intakes** **- Cutting into chilled water lines** **- Obstruct fresh air intake**	**Temperature is critical in GPICU, etc. Infection Control issues** **Major Air Quality Issues**
Fire Alarm and Sprinklers	**- ANY modifications** **- covering or removing smoke heads** **- Demolition & Excavation** **- Damage or set off sprinkler heads** **- Ductwork modifications**	**- Compromising Fire Safety** **- False Alarms** **- Floods** **- Major disruptions and distractions** **ALL THE ABOVE CAN RESULT IN DEATH**
Code Alarms **Nurse Call** **Wander Guards**	**- Demolition & Excavation** **- Unplugging** **- Changing the position of switches/breakers**	**Lack of communicating system can result in patient death or injury**

Appendix: B

Infection Control Risk Assessment (ICRA)

Step 1. Use the following chart to identify the **Type of Construction Project Activity (Type A-D)**

Type A	**Inspect and Non-invasive Activities:** Includes, but not limited to: **Removal of ceiling tiles for visual inspection limited to 1 tile per 50 square feet** Painting (but not sanding) Wallcovering, electrical trim work, minor plumbing, and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection
Type B	**Small scale, short-duration activities which create minimal dust:** Includes, but not limited to: Installation of telephone and computer cabling Access to chase spaces Cutting of walls or ceiling where dust migration can be controlled
Type C	**Work that generates a moderate to a high level of dust or requires demolition or removal of any fixed building components or assemblies:** Includes, but not limited to: Sanding of walls for painting or wall covering Replacement of floor covering, ceiling tiles and casework New wall construction Minor ductwork or electrical work above ceilings Major cabling activities Any activity which cannot be completed within a single work shift
Type D	**Major demolition and construction projects:** Include, but not limited to: Activities that require consecutive work shifts. Requires massive demolition or removal of a complete cabling system. New construction

Is it likely the Contractor's staff will be placed at risk for infection with tuberculosis?
Is it likely their will be physical disruption of the water system/lines during the activity?
Selected Type of Construction: ___ Notes:

Step 2. Using the following table, identify the Patient Risk Group that will be affected.
If more than one group is affected, select the higher risk group.

Low Risk	Medium Risk	High Risk	Highest Risk
Office areas	Cardiology Echocardiography Endoscopy Nuclear Medicine Physical Therapy Radiology/MRI Respiratory Therapy	CCU Emergency Room Laboratories Outpatient Surgery Pharmacy Post-Anesthesia Care Unit Surgical Units	Any area caring for immunocompromised patients Cardiac Cath Lab Central Supply Intensive Care Units Medical Units Negative airflow rooms Oncology Operating Rooms

Select Patient Risk Group: _____ Notes:

Step 3. Match the Patient Risk Group with the planned Construction Project Type (A, B, C, D) on the following matrix to find the **Class of Precautions (I, II, III, and IV)** or level of infection control activities required.

Patient Risk Group	Type A	Type B	Type C	Type D
Low risk	I	II	II	III/IV
Medium risk	I	II	**III**	**IV**
High risk	I	II	**III/IV**	**IV**
Highest risk	II	**III/IV**	**III/IV**	**IV**

Select Control Procedures: _____

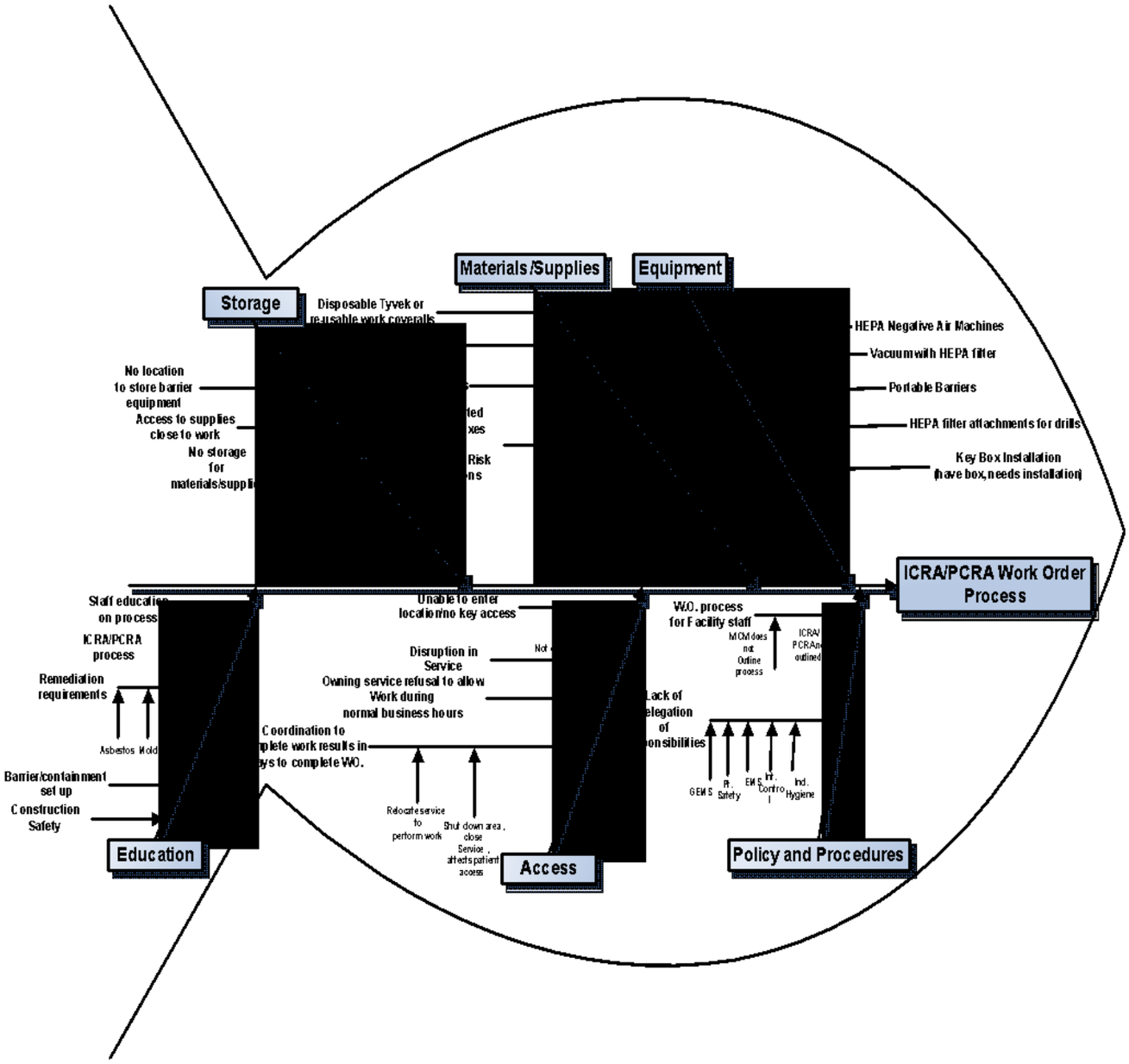
	During Construction Project	Upon Completion of Projects
Class I	1. Execute work by the method to **minimize raising dust** from construction operations 2. **Immediately replace a ceiling tile displaced for visual inspection**	1. Clean work upon completion of the task: EMS/SPS will complete major cleaning. Maintenance and contractor should remove any visible debris generated by their work.
Class II	1. Provide effective means to prevent airborne dust from dispersing into the atmosphere. 2. Water mist work surfaces to control dust while cutting 3. Seal unused doors with duct tape 4. Block off and seal air vents. 5. Place dust mat at the entrance and exit of the work area. 6. Remove or isolate the HVAC system in areas where work is being performed.	1. Wipe work surfaces with disinfectant. 2. Contain construction waste before transport in tightly covered containers. 3. Wet mop &/or vacuum before leaving the work area. 4. Remove isolation of the HVAC system in an area where work is being performed.
Class III	1. Remove or isolate the HVAC system in an area where work is being done to prevent contamination of the duct system. 2. Complete all critical barriers, i.e., sheetrock, plywood, plastic, to seal area from the non-work area or implement control cube method (cart with plastic covering & sealed connection to the worksite with HEPA vacuum for vacuuming before exit) before construction begins. 3. Maintain negative air pressure within the worksite, utilizing HEPA-equipped air filtration units. 4. Contain construction waste before transportation in tightly covered containers. 5. Cover transport receptacles or carts. The tape covering unless the solid lid is used.	1. Do not remove barriers from work area until the completed project is inspected by Safety Management & Infection Control & thoroughly cleaned by Environmental Management. Ceiling system and tiles must be in place before barriers are removed. 2. Remove barrier materials carefully to minimize the spreading of dirt & debris associated with construction. 3. Vacuum work area with HEPA-filtered vacuums. 4. Wet mop with disinfectant. 5. Remove isolation of the HVAC system in areas where work is being performed.
Class IV	1. Isolate the HVAC system in an area where work is being done to prevent contamination of the duct system. 2. Complete all critical barriers, i.e., sheetrock, plywood, plastic, to seal area from the non-work area or implement control cube method (cart with plastic covering & sealed connection to the worksite with HEPA vacuum for vacuuming before exit) before construction begins. 3. Maintain negative air pressure within the worksite, utilizing HEPA-equipped air filtration units. 4. Seal holes, pipes, conduits, and punctures appropriately. 5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving worksite, or they can wear cloth or paper coveralls that are removed each time they leave the worksite. 6. All personnel entering the worksite are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. 7. Do not remove barriers from work area until the completed project is inspected by Safety Management & Infection Control & thoroughly cleaned by Environmental Management.	1. Remove barrier materials carefully to minimize the spreading of dirt & debris associated with construction. 2. Contain construction waste before transport in tightly covered containers. 3. Cover transport receptacles or carts. The tape covering unless solid lid. 4. Vacuum work area with HEPA-filtered vacuums. 5. Wet mop with disinfectant. 6. Remove isolation of the HVAC system in areas where work is being performed.

Comments:

Note: Infection Control approval will be required when Construction Activity and Risk Levels indicate that Class III or Class IV control procedures are necessary when disruption in the water lines is a planned part of the activity.

Project: Class Type:
Proposed Start Date: Estimated Date of Completion:
Project Engineer: Project Contractor:
Date Approved by Infection Control Officer/designee:
Electronic Signature: Infection Control Nurse

Appendix: C


Materials /Supplies
Equipment
Storage
Disposable Tyvek or
HEPA Negative Air Machines
Vacuum with HEPA filter
Portable Barriers
HEPA filter attachments for drills
Key Box Installation
(have box, needs installation)
No location
to store barrier
equipment
Access to supplies
close to work
No storage
for
ICRA/PCRA Work Order
Process
Staff educatio
on process
ICRA/PCRA
process
Remediation
requirements
Asbestos
Mold
Barrier/containment
set up
Construction
Safety
Unable to enter
location/no key access
Disruption in
Service
Owning service refusal to allow
Work during
normal business hours
Coordination to
Relocate service
to
perform work
Shut down area ,
close
Service ,
affects patient
access
W.O. process
for Facility staff
Lack of
GEMS
Pt.
Safety
EMS
Int.
Control
Ind.
Hygiene
Education
Access
Policy and Procedures

Appendix: D

Action	We Expect That
Create ICRA Blueprints of Facility Buildings/Rooms	Assist Facilities staff in determining the level of patient risk related to construction activities to evaluate needs and assign Class of barriers required for work
Develop SOP of ICRA process for Work Orders	Assist staff in completing the process for ICRA Class identification
	Provides a streamlined process for completing work orders
Purchase toolboxes and tools for Compounded Sterile Products Area and Sterile Processing Services	Dedicated equipment for each area will decrease the risk of cross-contamination of tools used in other areas
	Tools will be maintained in clean working order
Educate general staff on the Work Order Process	Improve the submission of work orders
	Assist in access to spaces owned by the area requesting work
	Improve collaboration between Service Lines
Educate Facilities staff on Lead Abatement	Prevents safety risks to a team responding to work orders
	Certification in remediation activities will improve turnaround time on work orders and decrease costs
Educate Facilities staff on Asbestos Abatement	Prevents safety risks to a team responding to work orders
	Certification in remediation activities will improve turnaround time on work orders and decrease costs
Educate Facilities staff on ICRA/PCRA process	Will allow Facility staff to complete work orders that require minimal barriers and safety measures
	Improve safety for staff and patients
	Decreases risk for infection
	Improves collaboration between Safety, Infection Control, and Facilities
Educate Facilities staff on construction safety	Enhances safety for staff and patients
Educate Facilities staff on water remediation and mold abatement	Decrease the risk of mold growth to water-damaged materials
	Improves safety for staff and patients
Purchase supplies to meet barrier requirements outlined in ICRA	Improves ability to meet ICRA requirements
	Improves safety for staff and patients
	Improves access to the necessary supplies to complete work
Purchase materials to meet ICRA requirements	Improves ability to meet ICRA requirements
	Improves safety for staff and patients
	Improves access to the necessary supplies to complete work
Implement tracking of work orders	Assist in ensuring that the process is being followed
	Provides a means to assess the effectiveness of the interventions

Appendix: E

Equipment	Make/Model	Cost	# needed	Total
Stainless Steel Toolboxes	Waterloo/PP-2610BK	$ 21.42	2	$ 42.84
Air Scrubber	DRI-EAZ/F284	$ 999.00	3	$ 2,997.00
M18 VAC	Milwaukee/0880=20	$ 127.00	3	$ 381.00
HEPA VAC	Dayton/20X609	$ 1,725.00	1	$ 1,725.00
HEPA Air	Omnitec/OA200V	$ 2,268.00	1	$ 2,268.00
M18 COMBO	Milwaukee/2696-24 2680-20	$ 435.00	3	$ 1,305.00
M18 Hammer	Milwaukee/2712-22DE 48-11-1850	$ 599.00	3	$ 1,797.00
HEPA Filter	Milwaukee/49-90-1900	$ 22.00	3	$ 66.00
Pre-Filter	DRI-EAZ/F271	$ 12.00	3	$ 36.00
HEPA Filter	DRI-EAZ/F321	$ 172.00	3	$ 516.00
HEPA Filter	MI-T-M/19-0234	$ 220.00	1	$ 220.00
Pre-Filter	Omnitec/OFP2518	$ 190.00	1	$ 190.00
HEPA Filter	Omnitec	$ 554.00	1	$ 554.00
Cart	Rubbermade/FG453388BLA	$ 837.00	3	$ 2,511.00
Portable Containment Barriers	Abatement Technologies/AG8000PAS-RPM	$ 7,992.00	1	$ 7,992.00
Portable Containment Barriers	Abatement Technologies/AG3000MCCK	$ 4,849.00	2	$ 9,698.00
Tyvek	Dupont Tyvek/TY120SWH2X002500	$ 4.99	100	$ 499.00
Boot Covers	Dupont Personal Protection/FC454SGYXX010 0 00	$ 65.88	3	$ 197.64
Stainless Steel Multi-Tool	Graingers/6XDR8	$ 115.00	2	$230.00
Multi Bit Screwdriver	Klein Tools/3MHY7	$ 42.50	2	$ 85.00
Channel Lock Pliers	Channellock/430	$ 14.24	2	$ 28.48
Adjustable Wrench 6 and 10 inches	Milwaukee Tool/48-22-7400	$ 27.99	2	$ 55.98
Claw Hammer	Westward/6DWG3	$ 21.88	2	$ 43.76
Putty Knife 1.5 inch	Hyde/01140	$ 8.00	2	$ 16.00
Fluke Meter 117 Compact	Fluke/Fluke-117-NIST-D	$ 261.89	2	$ 523.78
Wire Stripper Pliers	Milwaukee/48-22-3079	$ 35.50	2	$ 71.00
Electrical Tape	Scotch/88-SUPER 3/4th by 66 feet	$ 7.20	2	$ 14.40
Duct Tape	3M/3979	$ 9.25	2	$ 18.50
				$ 33,978.48

Appendix: F

Problem/ GAP	Direct Cause	Root Cause
Proper Infection control protocols are not always being followed when work orders are being done	Weak knowledge of Infection Control requirements by Facility staff	Lack of structured training for staff of the elements of Infection Control intervention and accountability.
Facilities staff are not always finding the location where work is or seeing what is wrong when they get to a site, causing some work orders to be closed without being completed	Work Orders are not being put in by general staff with all the required or proper information	Lack of structured training for general staff on what data is needed on a work order and how to properly submit the work order.
When known proper Infection control precautions are not always put into place or installed correctly, patients are at risk for exposure to infectious microorganisms.	Lack of Infection Control equipment and limited training on how to install it.	Due to limitations of funds, some of the required equipment purchases were put on hold due to day to day operation funding needs, and there was no structured training for staff. There is also due to a lack of accountability by maintenance staff.

Appendix: G

ICRA TRAINING AWARENESS CLASS

December 19, 2019 - 8:00 a.m. - 4:00 p.m.
VA Medical Center -Room 1724-407
500 East Veterans Street, Tomah, WI 54660

- Promotes the communication, awareness, and protocol required for working in an occupied health care facility.

- Outlines protection methods and safe work practices for various trades and hospital personnel working in these types of facilities.

AREAS OF FOCUS:

AWARENESS
- Importance of hazardous material awareness
- What makes an occupied facility unique?
- Potential hazards that may be found when working in an occupied facility

CONTROLLING CONTAMINANTS
- Difference between contaminants and infectious agents
- Different types of construction barriers
- Proper way to use a HEPA machine
- Difference between positive and negative air flow

MOLD
- Why is mold unique in a health care facility?
- Mold remediation process
- How can mold change the scope of work?

ADMINISTRATIVE CONTROLS
- The role of an ICRA team
- Teaches you how to read an ICRA form
- Importance of a firestop system in an occupied facility

WORK PROTOCOL
- Important safety considerations when working in an occupied facility
- Importance of using designated routes when bringing construction material to and from the jobsite
- Why is it important to cover equipment and finishes?
- Importance of placards

NORTH CENTRAL STATES REGIONAL COUNCIL OF CARPENTERS

CONTACT:

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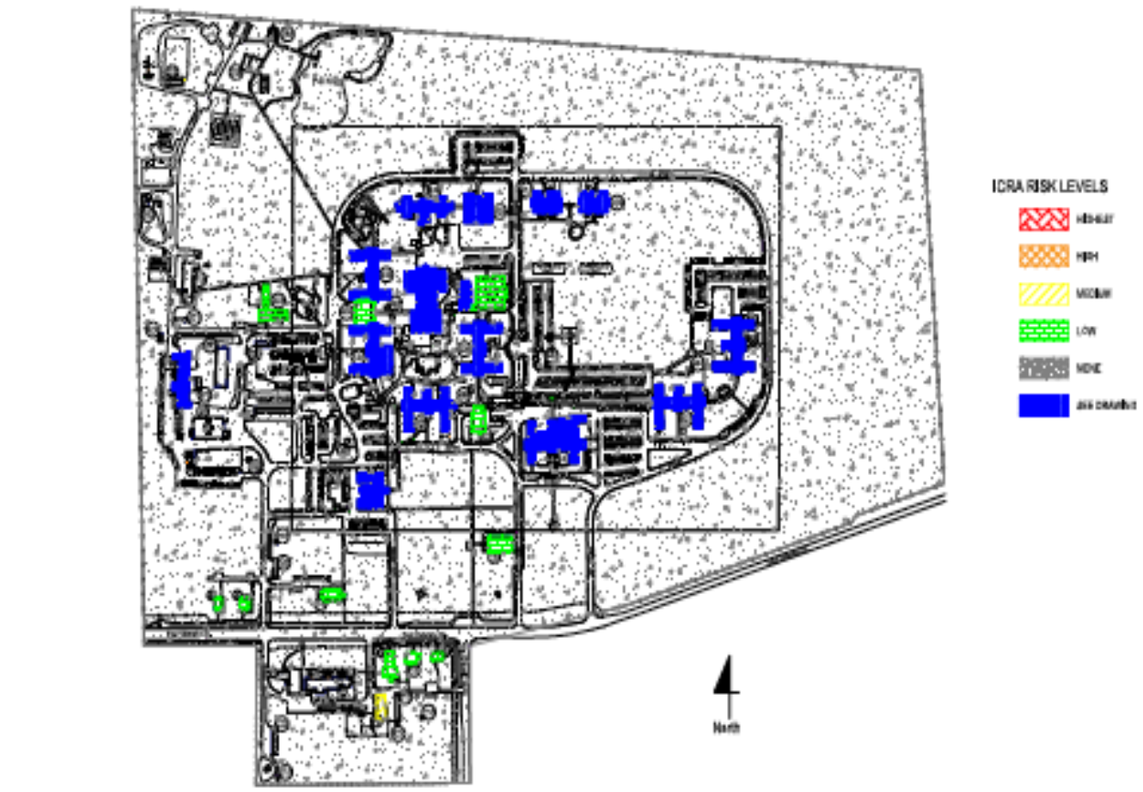
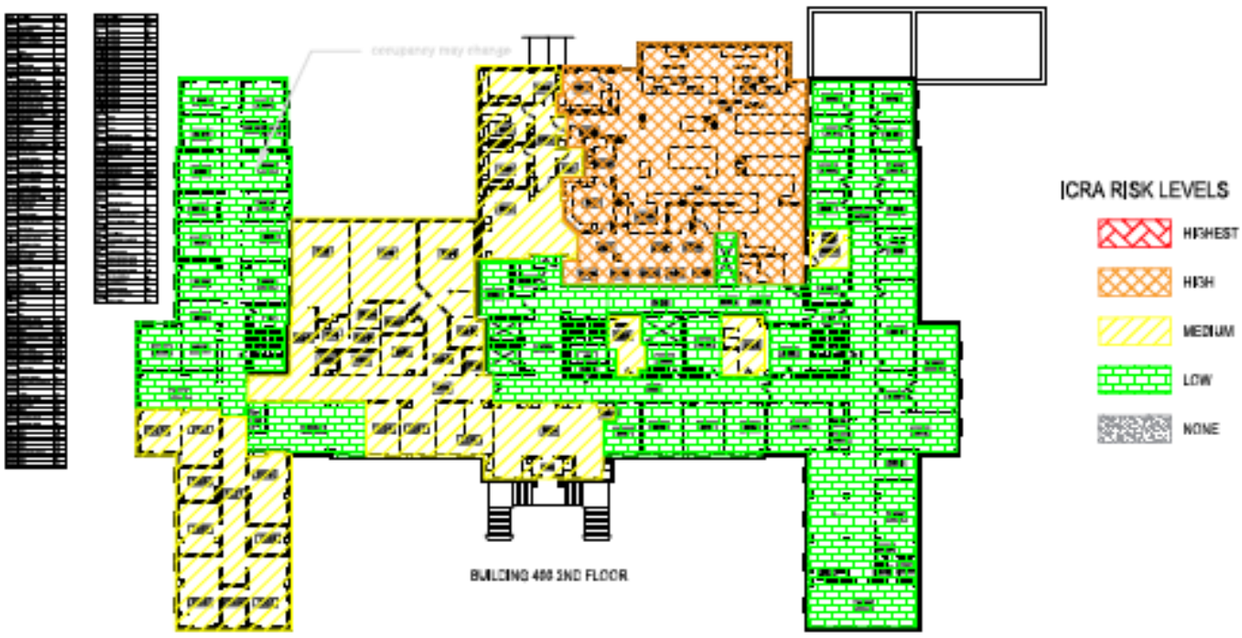
Appendix: H


ICRA RISK LEVELS
North


ICRA RISK LEVELS
HIGHEST
HIGH
MEDIUM
LOW
NONE
BUILDING 400 2ND FLOOR

Appendix: I

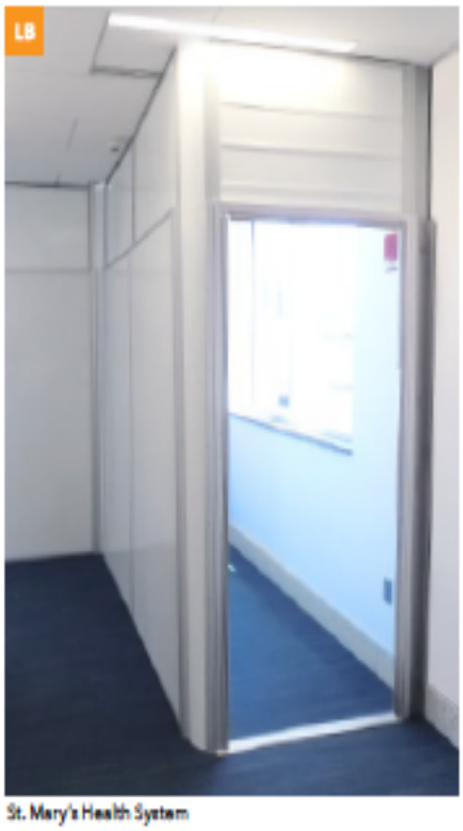
Abbott Northwestern Hospital

"This is the best solution I have seen for keeping the patient population protected from noise, dust and any other potentially hazardous materials during renovations in a hospital environment."

DANIELA SKALINA
Infection Control Director
Central Maine Medical Center

Aurora Sinai Medical Center

Sidney & Lois Eskenazi Hospital



St. Mary's Health System

Appendix: J

STARC SYSTEMS

STARC Systems, Inc.
166 Orion Street
Brunswick, ME 04011
(844) 596-1784 x104
sales@ starcsystems.com
www.starcsystems.com

General Information

Quote Number	21741	Account Name	
Created Date	1/3/2020	Contact Name	Chris Michael
Expiration Date	4/2/2020	Phone	
FOB	Brunswick, ME	Email	christopher.michael2@va.gov
Ship Date	1/17/2020	Terms	100% Balance Due Upon Receipt

Address Information

Bill To	Healthcare System Attn: Accounts Payable United States	Ship To	Healthcare System United States

Line Items & Total

Product Code	Product	Sales Price	Quantity	Discount	Total Price
LB-CUST-0002	STARC LiteBarrier 42" Hinged Door with OTD Kit, Hardware Spares, WITHOUT Handleset, and Closer, machined for S3-SHS handleset	$1,230.00	2	23.00%	$1,894.20
S3-SHS-SFIC	Schlage Handle Set, Small Format / BEST Interchangeable Core Cylinder configuration (Removable core not included)	$395.00	2	23.00%	$608.30
LB-HDC	LiteBarrier Door Closer, CRP 420-P	$85.00	2	23.00%	$130.90
LB-WM-48	STARC LiteBarrier Wall Module 48" x 6'-10" - 10'-5"	$675.00	2	23.00%	$1,039.50
LB-WM-36	STARC LiteBarrier Wall 36" x 6'-10" - 10'-3"	$600.00	2	23.00%	$924.00
LB-AIR-24	STARC LiteBarrier 24" Negative Air Mgmt Panel 12" Duct Vent 24" x 6'10" - 10'-3"	$750.00	2	23.00%	$1,155.00
LB-WM-18	STARC LiteBarrier Wall 18" x 6'-10" - 10'-3"	$450.00	2	23.00%	$693.00
LB-WM-12	STARC LiteBarrier Wall 12" x 6'-10" - 10'-3"	$400.00	2	23.00%	$616.00
S1-RPM-RT1	ABATEMENT standard single room wall mounted differential pressure monitor	$1,200.00	1	23.00%	$924.00
LB-FC	STARC LiteBarrier Flexible Corner: 15-90 deg. 12ft Max Height	$275.00	2	23.00%	$423.50
LB-LFP	STARC LiteBarrier Left Wall Filler Panel, Extendable	$210.00	2	23.00%	$323.40
LB-RFP	STARC LiteBarrier Right Wall Filler Panel, Extendable	$210.00	2	23.00%	$323.40
LB-JP	Quad Joiner plate	$7.75	4	23.00%	$23.87
LB-FGC	LiteBarrier Flush Tile Ceiling Grid Clip 9/16 -15/16" Grid	$8.00	14	23.00%	$86.24
LB-TB	LiteBarrier Tool Bag with spares and documentation	$30.00	1	100.00%	$0.00
S1-MC	Mobility Cart, 8 panel capacity, with straps and 5" swivel locking casters	$600.00	1	23.00%	$462.00
SHIPPING -	Estimated Freight Charge - FOB Brunswick	$372.00	1		$372.00

Total $9,999.31

Sales tax is the buyer's responsibility and will not be collected or remitted by the seller.